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(19)

(54) PLY-BONDING METHOD & PRODUCT

(71) We, PAPER CONVERTING MACHINE COMPANY, a Corporation organised and existing under the laws of the State of Wisconsin, United States of America of 2300 South Ashland Avenue, Green Bay, Wisconsin 54305, United States of America do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed to be particularly described in and by the following statement:

This invention is concerned with bonding together superposed webs, in particular bonding sheets of paper. The invention includes a method and webs bonded together by the method of the invention.

Reference is directed to co-pending Application No. 8592/74 (Serial No. 1420140) similarly concerned with ply bonding.

According to the invention a method of ply bonding superposed webs comprises moving the webs whilst applying compressive forces along two transversely spaced lines parallel to the direction of movement, the directions of said forces being convergent.

The webs will be ply-bonded by apparatus including a wheel and an anvil roll having a groove for reception of the wheel, bevelled edges on both sides of the wheel and bevelled edges of the groove forming cooperating parallel planar surfaces.

With this technique, relatively light wheel forces can result in tremendous unit pressures without the problem of deleterious wear which is present in the prior art. On wide machines, in the range of 100 inches to 200 inches web width, with a number of ply-bonding units across the machine width, deflection of the anvil roll has in the past been a very serious factor.

Examples of the invention will be described with reference to the accompanying drawing, in which:

[*Price 33p*]

FIG. 1 is a fragmentary side view, partially in cross section, of apparatus;

FIG. 2 is an end view of the apparatus of FIG. 1 such as would be seen along the sight line 2-2 on FIG. 1;

FIG. 3 is an opposite end (or top) view of the apparatus of FIG. 1, such as would be seen along the sight line 3-3 on FIG. 1;

FIG. 4 is an enlarged fragmentary sectional view such as would be seen along the sight line 4-4 on FIG. 1;

FIG. 5 is a still further enlarged fragmentary cross-sectional view representing an enlargement of the encircled portion designated 5 in FIG. 4;

FIG. 6 is a fragmentary plan view of web materials wherein the plies thereof have been bonded with one portion enlarged and encircled and designated 7;

FIG. 7 is a sectional view taken along the sight line 7-7 on FIG. 6;

FIG. 8 is an enlarged transverse sectional view seen along the sight line 8-8 on FIG. 6;

FIG. 9 is a fragmentary plan view of web material bonded together and constituting a modification of that seen in FIG. 6; and

FIG. 10 is another fragmentary plan view of the web materials wherein a still further modification of a bonding pattern is provided.

Referring first to FIGS. 1 and 2, the numeral 10 represents a cross shaft which extends between frames (not shown) provided in a web handling machine.

The cross shaft 10 supports a bracket 11 which is fixed to the cross shaft 10. The bracket 11 includes parts 12 and 13 bolted together by means of bolts 14 and 15.

The bracket 11, through parts to be described hereinafter, rotatably supports a toothed, edge-bevelled wheel 16. The wheel 16 operates in conjunction with a grooved roll 17 to perform the ply bonding on a

web 18.

Reference is now made to FIG. 4 wherein fragmentary portions of the wheel 16 and roll 17 are depicted. The roll 17 is advantageously driven (by means not shown), while the wheel 16 can be considered an idler. The wheel 16 has bevelled dges providing surfaces 19 and 20 and the roll 17 has a slot or groove 21 defined by insert plates 22 and 23 maintained in spaced apart relation by means of a spacer 24. The outer edges of the plates 22 and 23 are bevelled, as at 25 and 26, parallel to bevelled surfaces 19 and 20 on the bonding wheel 16. This can be even more readily appreciated from a consideration of FIG. 5 where the engagement of the bevelled surfaces 20 and 26 is shown in further enlarged scale.

This results in a unique bonding of the plies of elongate web material. The sheets, when bonded, have a surface appearance such as that seen in the circled upper left hand corner 7 of FIG. 6 where two relatively elongate depressions 27 and 28 appear. Also seen in the upper left hand corner of Fig. 6 is a portion of a prior pair of depressions 29 and 30. Interposed between the successive pairs of depressions 27/28 and 29/30 is a relatively undepressed, unbonded area 31. The unbonded area 31 can be seen readily in FIG. 7. The length of the depressions (or compressed areas) 27/30 and the corresponding "length" dimension of the unbonded area 31 are determined by the character of the teeth 16a (see FIG. 1) on the bonding wheel 16. For example a wide variety of tooth sizes and spacings may be employed. The number of teeth on a 3-inch diameter wheel may be as many as 70. The spacing 31 may have an arcuate length of .02 to .10" or more, depending upon the work and apparatus employed. Wheels of this general character have been employed in the past for longitudinal perforating where they operate against hardened anvils and have required special steels because of the high pressures involved.

For apparatus used in bonding tissue and light weight towelling, a thickness of the spacer 24 of the order of about 0.02" is advantageous. In such a case, the length of the cooperating portions of the bevelled surfaces 25 and 26, viz., the length A in FIG. 5, is about 0.005". Still further, a wheel is advantageously used wherein the included angle between the bevelled edge surfaces, viz., the angle B in FIG. 4, is in the range of 45° to 90°, with the included angle of the bevel surfaces 25 and 26 corresponding. With an arrangement with only 14 pounds force on the wheel 16 (the means for which to be described hereinafter), and with an included angle B of 60°, a large pressure on the web material, i.e., of the order of 50,000 psi is developed. Arrangements are advantageously used whereby the compressive force on each pair of cooperating bevelled surfaces is in the range of 40,000 psi to 80,000 psi. This results in a "glassining" which is illustrated schematically in FIG. 8. The web material is not slit or severed, but is compressed to such an extent that it has the translucent characteristic of a glassine—heretofore used frequently as bread wrap, etc.

Reference is now made to FIGS. 1 to 3 for the purpose of explaining an example of a means for loading or applying force to the bonding wheel 16 i.e. urging it into groove 21. A variety of techniques can be employed for this purpose, particularly in view of the relatively light force that is used. However, this arrangement shown does permit adjustment of the bonding wheel relative to the groove (so as to accommodate wear) without the need to vary the load on the wheel itself.

A wheel holder 32 is pivotally mounted at 33 (see the middle portion of FIG. 1) on the bracket 11. For this purpose, a pivot shaft 34 is provided which can also be seen in dotted line in FIG. 2. The wheel 16 is equipped with a ball bearing 35 (see the extreme middle left hand side of FIG. 2) which permits it to rotate freely relative to fixed shaft 36. The shaft 36 is fixed within the bracket 32 by means of a set screw 37 and has an enlarged end as at 38 to hold the bonding wheel 16 in position. The bonding wheel is seen to be offset from the center line of the bracket 11 (Fig. 2), and this is advantageous because an opposite hand unit can be installed immediately adjacent the one pictured in FIG. 2 so as to give relatively closely spaced lines of longitudinal bonding.

The wheel holder 32 is bifurcated as at 39 (see FIG. 2) to provide a pair of integral lug portions 40 and 41 (see FIG. 3). The bracket 11 is likewise bifurcated to provide a pair of integral lug portions 42 and 43.

A pin 4 is inserted through aligned openings in the lug portions 40 and 41, and similarly a pin 45 is inserted through aligned openings in the lug portions 42 and 43 provided on the bracket 11. Each pin 44 and 45 in turn is equipped with a transverse opening for reception of a cap screw 46. The cap screw 46 is threaded at end 46a, and is threadedly received within the bore provided in the pin 44. On the other hand, the transverse bore or opening in the pin 45 provides a clearance for the shank of the cap screw 46.

A nut 47 is threadedly received on the cap screw 46, and provides a stop for a

coil spring 48. The other stop is pr vided by the pin 45.

Turning the cap screw 46 will change the position of the pin 44 relative to the length of the cap screw, and thus will move the wheel 16 relative to the anvil roll 17—by pivoting around the point 33. This occurs without any change in the pressure on the bevelled surfaces 25 and 26. To increase the pressure, the lock nut 47 is repositioned, changing the length of the spring 48.

A small air cylinder or like means may be used in place of the cap screw 46, spring 48, and nut 47 so as to do away with the adjustment of the cap screw 46 and lend itself to remote control when desired.

In the practice of the invention, a 99-inch wide rewinder for 2-ply toilet tissue requires 44 of the assemblies, viz., the bracket 11, wheel 16, etc. In such a case, the ply bond units may be engaged only just before and after cutoff and for only a few feet. This makes the transfer to the new core easier, and prevents the user from unwinding the wrong plies at the beginning of a new roll. When the latter happens, the perforations do not match between the plies, and the user can get very upset.

For towelling and other 2, 3, or 4-ply products, where relatively large areas are involved, continuous ply bonding along the two edges may be desirable, and intermittent, short, ply bonding in whatever pattern desired over the rest of the surface. This is illustrated in FIG. 10. Any intermittent ply bonding may be accomplished by pivoting the shaft 10 or through cam actuating means against a variation of cap screw 46, or by air as mentioned above by simply pulsing the pressure between 0 and 14 lbs. In this connection, bonding across lines of perforation may be achieved as illustrated in FIG. 9.

Many variations of the ply bonding patterns are possible. The distance between the two lines may be increased from the form illustrated—viz., about 0.020″—to one inch or more. Further, the teeth 16*a* may be at an angle to a tangent at the periphery of the wheel. Two ply bonding wheels may possibly be used with a spacer in between with the teeth staggered if desired. In this case, only the outer edge bevelled surfaces of the two wheels would be used. Further, instead of the ply bonding wheel, the anvils may be toothed. This, however, is more expensive and is not preferred. Also, both the wheel and anvils could be toothed, but no real advantage is seen to this approach, even if the ply bonding wheel would be driven in order to match or mismatch the teeth. This apparently would only be more expensive.

WHAT WE CLAIM IS:—

1. A method of ply bonding superimposed webs comprising moving the webs whilst applying compressive forces along two transversely spaced lines parallel to the direction of movement, the directions of the forces being convergent.

2. A method of ply bonding webs substantially as hereinbefore described with reference to the drawings.

3. Superimposed webs ply bonded according to claim 1 or 2.

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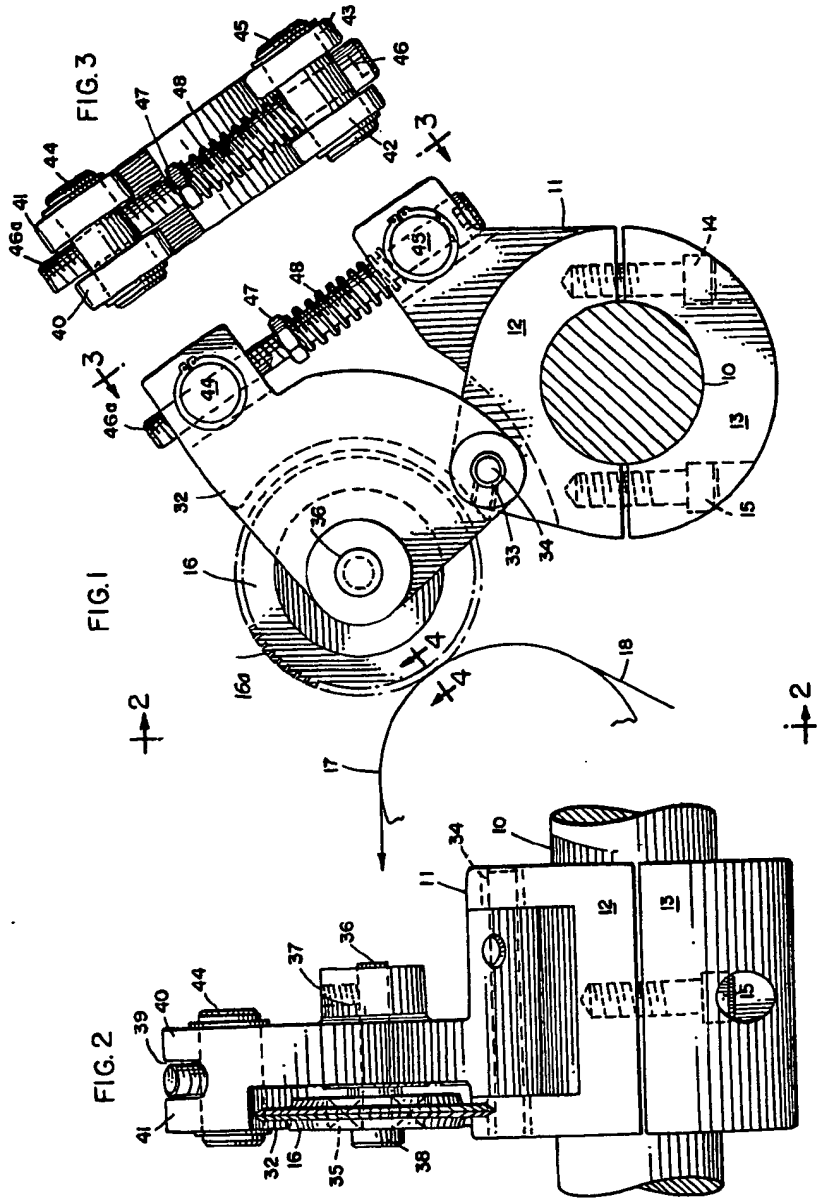
2 SHEETS This drawing is a reproduction of the Original on a reduced scale
Sheet 1



1420139 COMPLETE SPECIFICATION
2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 2